



Role of Salivary Alkaline Phosphate in Detecting Oral Diseases- A Review

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Abstract

Alkaline phosphatase is a hydrolase intracellular enzyme participating in the metabolic processes of cells. Rise in salivary ALP levels reflects inflammation and destruction of healthy tissues suggesting it as a biomarker. This review article has been done to analyse the role of Salivary Alkaline phosphatase in detecting the oral disease. Monitoring the level of the alkaline phosphatase in saliva can help in regulating the oral health of patients.

Introduction

Early detection and diagnosis of disease yields good prognosis of the disease.⁽¹⁾ Biomarkers can be useful tool in predicting ongoing or future disease activity. They have the ability to determine the current activity status of diseased sites.⁽²⁾

The detection methods for an oral disease need to be non –invasive and economic for the patient's comfort.⁽¹⁾ In such cases, Saliva as a diagnostic tool plays an excellent role by detecting the levels of salivary biomarkers. It has greater sensitivity; easy transportation and storage, correlation with blood are its advantages.⁽¹⁾ Whole saliva, gingival crevicular fluid, plaque and serum can be used as source of specimen for these markers.⁽¹⁾ Whole saliva can be collected easily as compared to GCF in large amounts with less discomfort.⁽³⁾

Among the salivary biomarkers, alkaline phosphatase plays a prime interest especially from the dental aspect.⁽¹⁾ The normal level of alkaline phosphatase is 20-140IU/L (international unit per

litre). The level of the enzyme may vary depending upon the factors such as age, gender, blood type etc⁽⁴⁾. Due to constant growth, children have higher values of alkaline phosphatase in their serum especially during growth spurt.⁽¹⁾ Alkaline phosphatase creates a pH favourable for hydroxyapatite crystal formation in bone matrix. This makes the ALP as a biomarkers for diagnosis of bone related conditions.^(5,6,7)

Salivary Alkaline phosphatase and Periodontitis

Periodontal disease is characterised by complex host-parasite interactions that lead to gingival inflammation, loss of connective tissue attachment, periodontal ligament destruction and alveolar bone resorption.⁽⁸⁾ The enzyme Alkaline phosphatase is released by secondary granules of neutrophils and its concentration increases significantly with plaque accumulation and increases inflammation.⁽¹⁾

Untreated chronic periodontitis patients exhibit higher level of alkaline phosphatase in whole saliva than did healthy control.⁽⁹⁾ Ishikawa and Cimasony showed positive correlation in levels of alkaline phosphatase in periodontitis patient with pocket depth.⁽⁷⁾ Studies reported that the level of the alkaline phosphatase was increased during the acute phase of periodontal disease which was restored to normal level after periodontal therapy.⁽¹⁰⁾

The increase in the activity of other salivary enzyme like creatinine kinase, lactate dehydrogenase, aspartate aminotransferase, alanine and gamma glutamil transferase indicates damage to the soft tissue but increase in level of alkaline phosphatase indicates pathological damage to the alveolar bone.⁽¹¹⁾ This helps in differentiating the various stages of periodontitis and thus plays an important role in monitoring the disease activity of the patient.

A study was conducted at Mangalore University which had comparison of two groups for the levels alkaline phosphatase.⁽¹²⁾ The group I consists of 20 post menopausal women without chronic periodontitis in age group of 50-60 years and group II consists of 20 post menopausal women with chronic periodontitis. ALP levels in saliva of group II was higher due to increase in inflammation and bone turnover rates. They concluded that salivary ALP levels could be used as additional diagnostic aid in diagnosing periodontitis in post menopausal women.

Use of Salivary Alkaline Phosphatase in Orthodontics for Jaw Growth Prediction

Some studies evaluated salivary ALP changes as diagnostic tool to optimise the timing in orthodontic treatment.⁽¹³⁾ The Angle Orthodontist conducted a study of 50 healthy subjects. Collection of saliva was done and growth face was assessed through vertical vertebral maturation method. A peak in the ALP activity was found in the pubertal growth face. The study concluded ALP activity has potential as diagnostic aid for identification of the pubertal growth face. Ameer

et al. in 2015 conducted a study to evaluate the activity of ALP in saliva during Orthodontic tooth movement using different magnitude of continuous orthodontic forces in 30 Orthodontic patients aged 17-23 years with Class II division I malocclusion all requiring bilateral maxillary first pre-molar extraction.⁽¹⁴⁾ The result revealed that there is increase in ALP enzyme level with increase in magnitude of Orthodontic forces.

Alkaline Phosphatase Level in Malignancy

Cancer is the second most common disease in India responsible for maximum mortality.⁽¹⁵⁾ The rate of Oral cancer incidents has reported a sharp increase in these recent years.⁽¹⁶⁾ Though, Biopsy needs to be done before treatment plan but since it is an invasive procedure and all patients are not willing for biopsy as lesion is usually asymptomatic. Some studies have found that there is increased level of alkaline phosphatase and lactate dehydrogenase in Oral leukoplakia.⁽¹⁷⁾ Thus, this has convinced the patient willingness as it is a non invasive and cost effective.

Cellular Alkaline phosphatase is considered to be a marker of induction of tumour cell differentiation.⁽¹⁷⁾ Dhivyalakshmi et al studies showed that lactate dehydrogenase can be more reliable than Alkaline phosphatase in the diagnosis of oral carcinoma.⁽¹⁸⁾ Merza et al found that Alkaline phosphatase level has been found to be more striking in case of local malignancy.⁽¹⁹⁾

Alkaline Phosphatase Level in Bone disorders

Fixed or removable prosthesis to geriatric patients mainly depends on the quality and quantity of the bone. The mineral component of bone is calcium and phosphorous along with which Alkaline Phosphatase is also secreted in saliva. So analysis of saliva for Alkaline phosphatase can detect any underlying bone disease.⁽²⁰⁾ A study was conducted to evaluate the level of salivary calcium and alkaline phosphatase in osteoporosis patients. It was found that the levels of calcium and alkaline phosphatase were found high in osteoporotic and osteopenic patients.⁽²⁰⁾

Paget's disease can be only well diagnosed by evaluating the Bone Specific Alkaline Phosphatase (BSAP) levels from the serum of the patients. The high levels of BSAP are elevated in Paget's disease.⁽²¹⁾

Conclusion

Based on the literature studies related to Salivary Alkaline phosphatase level, it has been found that the Salivary Alkaline phosphatase can be used as an immediate diagnostic aid for many oral diseases and in monitoring the disease activity in the patient.

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